Guarding the eyesight of the World

by

Newton Fuessle

So great and extraordinary a strain has been imposed upon human eyesight by the pressure of modern life that thirty-four out of every hundred adults in large cities are found to wear glasses all or part of the time

GUARDING THE EYESIGHT OF THE WORLD

BY NEWTON FUESSLE

VERY seat in the club car of the Congressional Limited was taken when the train pulled out of ıington. Among the last of the pas-ers to get aboard was a foreign mat; he was to deliver an address night in New York, and counted on ve hours' journey to put the final ı on his manuscript. A half-hour's e, and he would be ready for the

ssing through the club car, he ed onto the observation platform, e he found a camp-chair vacant. ll luck lay in wait. A sudden gust nd and a forty-mile swerve round ve cost him his eye-glasses. Fifty down the track they struck and ered.

ring his entire career this diplomat been expounding preparedness, but he was caught unprepared. For he ed no duplicate pair of glasses.

reating to the interior of the car, ıs at once recognized and was soon unded by a sympathetic group.

your Excellency will pardon me," one of the group, "I should like to a suggestion. Why don't you wire Baltimore to your oculist in Wash-n? Request him to wire your pre-tion to a New York optician, asking to fill it and to deliver the glasses u by the station-master when you e in New York. Have your oculist you at Philadelphia if the plan is ble."

it possible that this might really one?" demanded the foreigner in ement.

think so, your Excellency," smiled ther confidently. He was an optical alist, and was not given to guess-

e story of the distinguished travel-misfortune and of the novel project vercome it ran through the car. e was eager speculation as to the me. And when, at Philadelphia, a telegram was delivered which read, "Your glasses will be at Pennsylvania Station as requested," everybody looked happy and relieved.

"Ah, you Americans!" said the diplomat, wringing the hand of the man who had made the fortunate suggestion. "In my country such resourcefulness would never have been thought of."

A score of conversations had in the meantime been turned loose on the subject of glasses. Comment turned to the number of men in the car who were wearing glasses—twenty-one out of thirty. The men discussed the reasons for the greatly increased wearing of glasses over ten or twenty years ago. Human eyesight and the effects of strenuous modern life upon it were thoroughly aired until the train pulled into New York.

It was brought out that there were more children in the schools, and that they were spending more years in school than previously, with more strain and injury to eyes resulting from study. More people than ever before were engaged in closer tasks at office desks and machines. The nervous, fast-moving character of modern life seemed to affect the eyesight. Food was probably deficient in the vital elements needed by the nerves and tissues of the eye. The abrupt changes of illumination due to the general use and misuse of electric lights were cited. The tax of motion pictures on eyesight was argued. Some one explained that there was a rapidly growing understanding of visual defects and weaknesses, instead of the neglect of eyes that was so general in the past. Another cited the steady increase of competent optical specialists, not only in the cities but in small towns.

Views were fired back and forth in lively fashion, and interest in the diplomat's mishap and its happy outcome drew a curious group trailing after him on the train's arrival to see him receive a small package from the station-master.

Scientists in the Wellsworth plant have contributed largely during the past twenty years to the world's knowledge of how to discover and correct the errors in team work of a pair of eyes

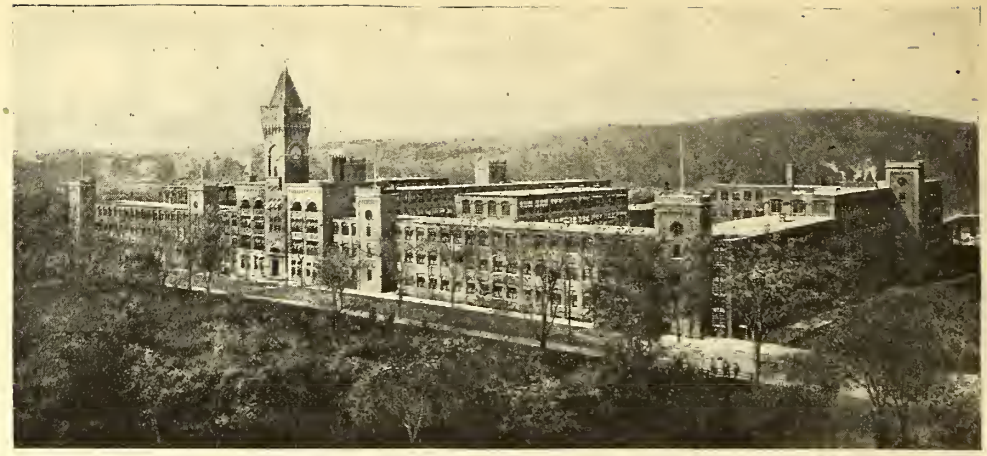
THE DIRECTING BRAINS OF THE NEW WIDESPREAD USE OF GLASSES

• It is estimated that one person out of every four in this country over five years of age wears glasses, and that 1,704,000 children wear them. It is estimated, moreover, that two people out of four who now wear glasses ought to have their present glasses changed.

The present enormous prevalence of glasses and the skill and exactness with which eyesight specialists everywhere are able to discover and measure the needs of eyes and to provide the correction could not just have happened.

Lodged in the green hills of Massachusetts stands an old and important fortress. It is a fortress of science and industry. Its guns keep up a heavy and continuous fire and their range is world-wide. They are interposing a vast, protective barrage of glass between the world's eyes and the destructive strain that assails them.

This industrial fortress is the Wellsworth plant. It leads the world in output of eye-glass lenses, frames, and optical machinery. But the world cares less about who leads in quantity output than it does about who leads the way to beneficial discoveries and inventions.



Lodged in the green hills of Massachusetts, stands an old fortress dedicated to science and industry—the Wellsworth plant

That kind of leadership is what I hope to bring out to readers just as I saw it and learned it. The location of this plant at Southbridge is peculiarly appropriate to its tasks. The skies above it are smokeless, and every approach to Southbridge is over roads that wind past hemlocks, pines, and mountain laurel, past rivers and glistening lakes, through luminous air, fragrant with leaves and bark and rugged earth.

The importance of this New England plant to the mentality, nerves, and comfort of the world is literally beyond computation. It has laid multitudinous tracks of clarified sight and perception that penetrate every realm of recorded knowledge. Reverent eyes that labor in the library of the Vatican, genius toiling over its manuscripts; *savants* scrutinizing the progress of their experiments in the laboratories—six out of ten of all these, and six out of ten of all eyes that wear glasses, are indebted for better sight to the American Optical Company.

So quietly and unobtrusively has this institution carried on its work that, although it was founded in 1833, and was the first firm to manufacture spectacles in this country, the public knows but little about its researches or its momentous contributions to the welfare of the human machine. Even the specialists who prescribe and dispense these lenses and frames at the rate of one million pairs each month have been kept so busy looking after their customers' needs that but few of these specialists have had time to visit the place where their materials are made and to watch the dramatic production of their wares. For out of a seeming welter of fire and pitch and earth, out of the red twilight of the polishing rooms, out of an ordeal that has hugely taxed human ingenuity, spring the gleaming, perfect lenses and the delicate parts which support them before the eyes.

This fascinating plant is the center and headquarters of the world's knowledge of optics. It has contributed largely to the improvement during the last twenty years of the knowledge, skill, and equipment of the profession. It has enabled eyesight specialists to discover and correct the real errors in team-work of a pair of eyes to a degree that has at last come very near to perfection.

"SLIPPERS" AND "LOUNGING ROBES" FOR THE EYES

The eye is the most delicate motor apparatus of the human body, and yet its muscles are subjected to a degree of abuse that no one would think of inflicting even upon his feet.

When Nature rolled up her cosmic sleeves and made human eyes, she designed the mechanism and arranged its delicate adjustments for the requirements of primitive outdoor life. That kind of life prevailed on the planet for so many thousands of years that the abrupt modern migration of the majority of the race to desks and work-benches has imposed close-range tasks upon eyes for which they are neither built nor adapted. Conditions of life have undergone great upheavals, but the eye has remained essentially unchanged. To adapt the eye to the strange, new requirements causes strain which, although unfelt, often ends in poor vision and poor health. Optical science has labored unremittingly to provide help in this modern emergency.

If the normal eye tax upon the mysterious force known as nervous energy consumes one-half of the total supply, then consider the surtax that is levied by incorrect eyesight. Even as little as one diopter of error of eyesight is computed to cause a wastage of twenty-five per cent of the entire nervous energy of the human body. Half of the people of the country are blundering along with uncorrected or improperly corrected eyesight, and are therefore wasting twenty-five per cent of their nervous capital. It is as if one spent four dollars every time one should be spending three dollars. This wastage drains energy away from the heart, the stomach, the brain, and from the entire muscular mechanism. It causes a terrific amount of fatigue and harm, and ninety per cent of all headaches. Its usurpation of man's allotted amount of nervous energy

In one building alone, daylight through two and one-half acres of glass illuminates the work of grinding, polishing, and inspecting lenses

An Institutional Story Advertisement

The predominating colors on the work-benches are crystal and gold

often causes neuritis and severe indigestion and probably shortens life itself.

Thus the therapeutic value of the right pair of glasses is very great, since it restores the flow of nervous energy into its natural channels. Digestive disturbances, hysteria, vertigo, and St. Vitus's dance have often been remedied or relieved by glasses.

New and amazing evidence of the physiological benefits of correct eyeglasses is piling up every day. Epilepsy in its early stages has been relieved and diminished by proper glasses.

We are a neurasthenic nation because we don't know how to relax. We put slippers on our feet and lounging robes on our backs for the sake of comfort and relaxation, but most of us do nothing to relax our eyes after the strain of the day's work. Yet there are "slippers" and "lounging robes" for the eyes, and even eyes free from serious optical error are learning the value of occasionally wearing "comfort glasses" to rest them.

FROM EMPEROR NERO TO GEORGE W. WELLS

As far back as ancient Babylon and China it had begun to dawn upon mankind that eyesight might perhaps be aided by artificial means; and from that time on students of natural sciences have little by little been digging out of the unknown and piecing together stray fragments of the science of optics and the art of spectacle-making. Emperor Nero, who was near-sighted, watched his gladiators through an emerald, and thus originated the lorgnette. Roger Bacon, "father of science," was the first to describe convex lenses, but to his religious contemporaries it was but the jargon of "black magic." A Florentine named d'Armati, who died in 1317, is believed to have invented spectacles. Several years later Galileo laid down common rules for finding the focal length of single lenses; Sir Isaac Newton discovered the refraction of light through prisms; Benjamin Franklin invented the first crude bifocal spectacles.

And destiny singled out another American in whom to embody great foresight and in whom to muster the energy required to assemble all existing knowledge of optics and apply it to lens-making, to organize the accumulated mass of fact and theory, and to combine it with the modern idea of quantity production. His name was George W. Wells.

Wells perceived that quantity production was imperative if the benefits of optical science were ever to be extensively conferred upon mankind. He also realized that the principles of quantity production must be employed in a way that would not diminish but would heighten precision and exactitude of manufacture. A man was required who was aware of the primitive state of optical science, and who would do his utmost to advance it. And just as critical hours in history have always produced the man to meet the needs, so this period of optical history produced its man of the hour, George W. Wells. What he did was to harmonize optical science with quantity production when the application of quantity production might easily have caused a dangerous discord.

In 1864, having been rejected on account of physical unfitness for service in the Civil War, he went to Southbridge and became one of the eleven employees in an optical shop, where, to the amazement of his companions, he was the first boy to take up the spectacle-maker's art without having served the usual apprenticeship of three years. One year sufficed, and thenceforth he devoted himself with resourcefulness and vigor to designing spectacle-making tools, dies, and machinery. In 1869 he and his brother determined to enter the optical business for themselves. Wells became secretary of the new enterprise, which was called the American Optical Company.

And now strange and surprising things began to happen. Heretofore a spectacle-maker had ground his own lenses and made the entire frame. It was a slow and laborious manual process. The first optical machine tools had been invented in France, and had been made practical in England, but it remained for America, under the impetus generated by George W. Wells, to make them effective to benefit the masses.

Founded here in 1833, it was the first firm to manufacture spectacles in this country

Six out of ten of all eyes that wear glasses are indebted for better sight to the researches of these laboratories

The Wells idea meant specialization. And by degrees each worker was given the one special task that he could perform the best. Thus the industry acquired speed and marvelous accuracy. Hand-work gave way to accurate and standardized machine work. There were no machines in existence to do much of the work, and so Wells had to invent and design a multitude of tools and machines; and modern spectacle-making began to acquire an accomplished momentum that astounded its British founders.

Until the time of his death ten years ago George W. Wells mingled almost daily with his craftsmen in the shops, inspecting the machines, alert to improve every process. For a long time he took an annual swing over the country, visiting optical specialists and looking after the correct use of his products. His physical might enabled him to work almost incessantly. He left nothing to chance. When he set his three sons to work in the shops, he told them that they could expect no favors, but that they would have to make their way solely by their own merits. To-day those three sons—Channing M. Wells, Albert B. Wells, and J. Cheney Wells—are directing the business and carrying out the ideals of the founder.

But the American genius for quantity production does not alone account for

the pre-eminent world position of the American Optical Company. That can only be explained by the genius of George W. Wells for combining with the principles of unerring quantity production the most searching and scholarly of scientific research.

ROYAL SOCIETY INSPIRES WELLS TO ASSEMBLE DISTINGUISHED SCIENTISTS

He had long admired the courageous and brilliant pursuits of the Royal Society of London, and was a fascinated student of this, the oldest scientific society in Europe, which since its founding in 1660 had led the world in improving natural knowledge. In its quest for lenses for the relief of cataract the Society had turned to Sir William Crookes, who, at the age of eighty-one, responded with the remarkable glass that bears his name.

Inspired by the Society's achievements, George W. Wells, having become the world's greatest manufacturer of glasses, adopted a policy thirty years ago that has brought into being a distinguished research group known as the Wellsworth Scientific Staff, whose members have been permitted to spend profits without stint to gain knowledge and apply it to the correction and relief of eyes.

England, which once led the world in this branch of optics, yielded with appropriate deference to the wizards of Wellsworth. England has produced many optical scientists since Sir Thomas Young, discoverer of astigmatism and the first to prove that light is a wave vibration, over one hundred years ago. Last October Dr. Charles Sheard, head of the Ocular Division of the Wellsworth Scientific Staff, appeared before the Imperial College and delivered the Sir Thomas Young Memorial Lecture—the fourth lecture in fifteen years. He was the first American interested in physiological optics to receive this highest of honors that the British Optical Society can bestow.

Sheard joined the Wellsworth Scientific Staff after he had made his course in optics at Ohio State University famous. Volume after volume of distinguished treatises have come from his pen. He has devoted himself vigorously and resourcefully to helping vision specialists to amplify their technique. The "Journal of Physiological Optics," published quarterly by the American Optical Company, embodies the illuminating record of his studies and is eagerly consulted by hundreds of oculists.

George W. Wells—the directing brain that founded and guided this evolution of the science and art of fitting defective eyes with proper lenses and their frames

Sheard is most famous for his dynamic ocular tests, and for laying down methods to discover whether a pair of eyes work together in comfort, and whether they can economically and efficiently carry on the function of seeing. He is the author of the only book originally written in the English language on physiological optics. He has written another book on ocular accommodation. He has gone deeply into the nervous innervations which cause the eyes of many children to be as old at the age of four or five as eyes at the age of forty-five or fifty.

The placard of letters used by the optical profession to test eyes was developed in 1862 at the University of Utrecht, and has been accepted ever since, but Sheard has disclosed some serious defects, and has developed up-to-date improvements. At the moment he is also developing important new trial frames used in ocular examinations in co-operation with other members of the Wellsworth Scientific Staff.

Seven years ago the only part of most lenses that was fairly right was a spot near the center. Science had striven for years to perfect the center and improve the outer areas—a baffling job in higher mathematics. It remained for Edgar Tillyer, of the Wellsworth Scientific Staff, to attain the goal. It took him three years to complete the calculations of better lens curves in all possible combinations, and now millions of the new lenses are being produced with "effective power" to take the place of inferior old-style lenses.

Tillyer designed better periscopes for submarines and developed the gun-sights for the French 37's. He is the man who made the bombing calculations for airplanes. At the United States Naval Observatory he computed the curves for new telescope lenses; it took him six hundred days to reduce one lens alone to its correct formula.

His contributions to the invention of the lensometer, just completed, provides optical specialists with an instrument of surpassing value. It is the world's first perfect lens-measuring instrument. It detects and discloses the minutest deviations from the perfect lens power prescribed.

RESEARCH BRINGS EYE COMFORT

At heavy expense the Wellsworth Scientific Staff developed a set of master lenses for testing eyes which has been certified to by the United States Bureau of Standards. Not only have these scientists created this standard of trial lenses, but they can duplicate that set to its own accuracy, an accuracy demonstrable down to five one hundred thousandths (5/100,000) of a millimeter—and a millimeter is one twenty-fifth of an inch. There are 28,000,000 people living to-day who have had their eyes tested by Wellsworth trial lenses.

The absorptive glass developed by this staff of scientists is unique. It is the most efficient ever produced, and is an improvement over the famous absorptive glass invented by Sir William Crookes, which absorbs the ultra-violet rays and has proved so beneficent in bringing comfort to uncomfortable eyes. The American Optical Company has its own instruments for the precise measurement of absorptive power of lenses, and these respective Wellsworth lenses are kept at identical absorptive points in order to provide a reliable basis of comparison of their benefits to the eye. There are elements

Lensdale, in the center of beautiful Wellsworth Park, where lenses are produced at the rate of a million pairs a month

of radiant energy that are "poisonous" to certain eyes, and the shielding effects of the right absorptive lenses have fascinated Wellsworth research men. They have likewise developed a tremendously hard and tempered glass for the protection of workers' eyes against flying chips of metal.

The researches, inventions, and results achieved by the American Optical Company cannot begin to be recorded in terms of only the individual efforts of Wells, Sheard, and Tillyer. To these names must be added Wrighton, Styll, Parsons, Clancy, Schumacher, Hill, and Maynard—all outstanding experts in their various fields.

Continuous pains are taken by the management to make each worker in the plants think of himself as a potential inventor; and inventions of valuable merit have often originated at the workers' benches.

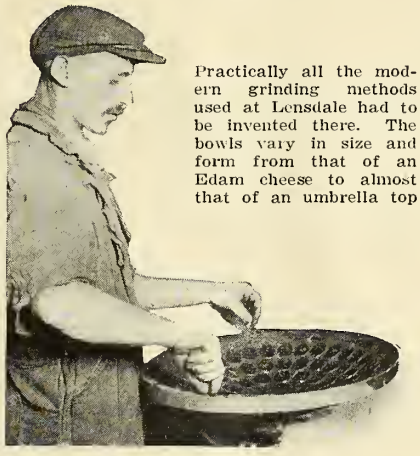
NO LONGER DEPENDS ON FOREIGN SUPPLIES

Up until five years ago the raw glass used for Wellsworth lenses was all supplied by a great firm of ophthalmic-glass makers in England. Only this famous glass plant could be depended upon to provide the quality of raw material needed. The outbreak of the World War naturally cut off the supply, and the Wellsworth staff promptly decided that no such stoppage of supplies, if preventable, should ever occur again. They began a long programme of experimental work with the glassmakers in this country, which resulted in the production of a highly perfected optical glass.

Lensdale is the name of the plant in which Wellsworth lenses are produced; and here is carried a supply of 1,500,000 pounds of raw glass at a time. It is molded in 1,600 degrees of oven heat, whence it is conducted through a succession of processes, many of which are unique.

Having inaugurated the quantity production of lenses, the American Optical Company has had to invent practically all the modern grinding methods it employs, together with the machines. Rows of the molded glass are affixed to the inside of shallow steel bowls and to the outside of similar bowls. Some bowls are tube shaped. They vary in size and form from that of an Edam cheese to almost that of an umbrella top, depending upon the various degrees of curvature required for the lenses. Each bowl revolves and sways in another bowl with an eccentric, double motion. On long rows of grinding machines filling a vast room they present a weird sight as the gigantic mechanical hands rub the lenses between their palms. Where emery is used as a grinding agent, it is the finest that Turkey produces, and even the process of washing and grading the emery had to be invented at Lensdale.

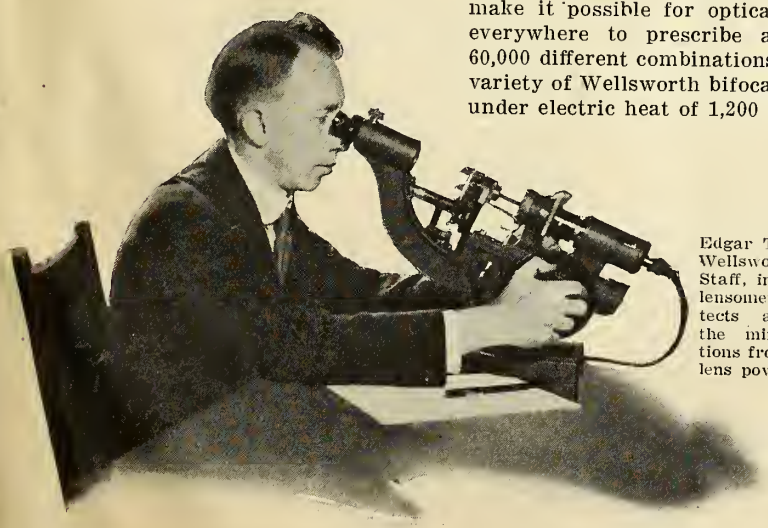
There are 70,000 window-panes in the luminous building where the finished lenses undergo their final inspections at the rate of 1,000,000 pairs every month.



Practically all the modern grinding methods used at Lensdale had to be invented there. The bowls vary in size and form from that of an Edam cheese to almost that of an umbrella top

The resourceful prescription department is constantly being called upon by the profession for orders that optical specialists are unable to fill. This department, although it carries 1,611 cylinder tools in its workshops, is constantly compelled to invent new tools to enable it to fill the orders that roll in.

The bifocal department produces enough different varieties of lenses to make it possible for optical specialists everywhere to prescribe as many as 60,000 different combinations. The fused variety of Wellsworth bifocals is treated under electric heat of 1,200 degrees, and in this department there are contrivances that protect it against even minute particles of dust that might interfere with a perfect product.



Edgar Tillyer, of the Wellsworth Scientific Staff, inventor of the lensometer, which detects and discloses the minutest deviations from the perfect lens power prescribed

Last October Dr. Charles Sheard, of the Wellsworth Scientific Staff, appeared before the Imperial College of London and delivered the Sir Thomas Young Memorial Lecture. He was the first American to receive this highest of honors that the British Optical Society can bestow

Practically all of the optical machinery used in England and the continent has been invented and made by the American Optical Company, which manufactures a complete line of lens-cutting, drilling, surfacing, and edging machines, some of them automatic.

These machines are noted for great speed, accuracy, and ingenuity. A new lens-cutting machine is now being developed that will cut a lens in any odd shape required.

STEEL GIVES WAY TO GOLD

George W. Wells held that the best lenses in the world were comparatively useless unless they were properly adjusted to the bridge of the nose, and a trip through the great frame-making departments is a revelation of painstaking methods and extraordinary equipment. Frames are made for every conceivable facial structure; 137 different styles of temples are made, of which the most popular is the comfort cable temple made of wire twisted around a thin core wire.

The present tendency toward zylonite, or "tortoise shell," frames required the invention of new Wellsworth machinery to handle the new material. The difficulty with zylonite was to secure correct adjustment to the wearer, and this has been overcome by the Wellsworth plant by designing forty different bridge dimensions.

The company's continuous research in metallurgy and alloys long ago made steel spectacles a thing of the past; "white metal," a new alloy, took their place; and then gold and gold-filled frames were popularized by the company's labors. Green gold and white gold have been added to the extensive line. The company has ushered the spectacle-wearing world from the age of steel to the age of gold, and its inven-

Wellsworth scientists studying and testing a new type of lens

tories show a half million dollars' worth or more of gold in its vaults at one time, received from the United States Mint in the form of bars and $20 gold pieces.

A multitude of astonishing machines and intriguing processes contribute their transformations to the materials employed before the countless little assortments of parts reach the workmen who assemble them. A few random impressions will convey an idea of the novelty and ingenuity of machines and methods.

The company's gold-filled frames, for example, are the result of a highly developed and remarkable process. Between the bar of gold alloy and its core is placed a third metal, all of the same ductility, so that they cannot pull apart and so that when drawn down to even the thinness of a pin the three metals maintain the same relative thicknesses. Thus the original bar, a foot in length and a trifle more than an inch in diameter, is sometimes drawn into as much as five and one-half miles of wire destined for spectacle frames.

Through the roaring batteries of bridge-reducing machines, lubricated by their continuous geysers of sperm oil, sweeps the precious yellow metal. It emerges from the automatic temple reducing machines a marvel of flexibility. The diminutive hammers of the automatic peening machines are the utter opposites of the deafening automatics used on steel girders; these minute hammers operate with only the faintest whisper of a sound; and one Wellsworth inventor has devoted himself for twenty-six years entirely to the development and improvement of these and other amazing little hammers. There are uncanny little automatic saws that nip through metal with an accuracy adjusted to a thousandth of an inch. Soldering is accomplished by sparks from little electric "pencils." One of the polishing processes is applied by mingling the delicate parts with little steel balls in a soapy solution in revolving tubs. The minute screws that go into Wellsworth frames come through at the rate of a million a week, and automatic screw-drivers drive them into their places.

A gambler out West once wrote to Southbridge wanting to place an order for a pair of glasses containing lenses powerful enough to enable him to see through the back of a playing-card. He was willing to pay any price. That is a sample of the inquiries that roll in continuously to the special order department. A man in New Orleans had a false nose and wanted to wear eyeglasses; and Wellsworth ingenuity promptly designed and made him a pair equipped with a little spike that entered the bridge of the nose. This department has designed special spectacle frames for horses that are to become high-steppers by having prismatic lenses placed before their eyes.

The pure refinements of mountings and frames that have been embodied in Wellsworth products have added vastly to the comfort, stability, and correct alignment of glasses, thus enabling the prescribed lenses to do their maximum work for the human eye.

The company's expert metallurgists are sponsors for the metal; the physicists guarantee correct lens curvature and correct transmission of light rays; the chemists guard every process that touches every class of material in the world. But the chief metallurgists, physicists, and chemists are thinking of what will be done next, not about what has been accomplished.

THE FINAL CUSTOM-MADE PRODUCT

The quick replacement of a pair of broken glasses always seems remarkable. Likewise how can these specialists in any town so quickly accomplish the tasks of final grinding, polishing, trimming, assembling, and mountin the parts of a pair of spectacles or glasses so they come forth a beau custom-made article, fitting the o without a change?

The answer lies largely in the his programme of the American Op Company, namely, to shoulder the w responsibility of spectacle-making out dependence upon outsiders. It ever been painstakingly mindful o fact that the lens manufacturer realize that ophthalmic lenses ca fulfill their function unless they ar curately and becomingly held in before the eyes. So it has electe devote itself to the making of each of eye-glasses under its own roofs, to co-ordinate them all under the ca direction of its own experts.

Eyesight specialists everywhere thereby able to secure all of their e ment, including optical machines, one authoritative source, which tributes greatly to the speed and cision of their work.

In the quantity production of oph mic lenses only one side of sp lenses is ground, leaving the final g ing to local eyesight specialists afte correct individual formula has bee rived at. In like manner, the fittir the frame to the individual's feat crowns the whole process of the n facture of frames and mountings. the right pair of glasses must be custom-made product of the local sight specialist.

The enormous value to humankir the optical lenses, frames, and m ings that bear the Wellsworth stan exactitude is translated into its terms of service to the individual b local profession. And the compa manufacturing efforts and research constantly focused upon providing sight specialists in every locality the most highly perfected equip that it is possible for science to pro

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